SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Show that

$$1+\left(\frac{1}{2}+\frac{1}{3}\right)\frac{1}{4}+\left(\frac{1}{4}+\frac{1}{5}\right)\frac{1}{4^2}+\left(\frac{1}{6}+\frac{1}{7}\right)\frac{1}{4^3}+\ldots\infty = \log\sqrt{12}\,.$$

17. Find by Newton's method on approximate value of the positive root of the equation $x^3-2x-5=0$.

18. Find the characteristic equation of $A=\begin{bmatrix}1 & 1 & 3\\ 5 & 2 & 6\\ -2 & -1 & -3\end{bmatrix}$ and show that the matrix A satisfies the equation.

19. Solve the system of equations

$$x-3y-8z=-10$$
$$3x+y-4z=0$$
$$2x+5y+6z=13.$$

20. Prove that :

$$\frac{Sin\,5\theta}{Sin\,\theta}=5-20\sin^2\theta+16\sin^4\theta.$$

APRIL/MAY 2025

FAEL12/CAEL12 — BASIC MATHEMATICS – I

Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. State the Binomial theorem for a rational index.
2. Write down the expansion of $(1-x)^{-2}$ and find the co-efficient of x^n.
3. Classify the equation

$$6x^5-11x^4-33x^3-33x^2+11x+6=0.$$

4. Define reciprocal equation.
5. If $A=\begin{bmatrix}1 & 2\\ 4 & 3\end{bmatrix}$ then find A^{-1}.
6. Prove that the matrix $\begin{bmatrix}\cos\theta & -\sin\theta\\ \sin\theta & \cos\theta\end{bmatrix}$ is orthogonal.
7. Define symmetric and skew symmetric matrix.

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8. If $A=\begin{bmatrix}1 & 3 & 5\\ 4 & 5 & 6\end{bmatrix}$ $B=\begin{bmatrix}0 & 5 & 6\\ 7 & 8 & 9\end{bmatrix}$ then find $A+B$ and $A-B$.

9. Expand $\tan 7\theta$ in terms of $\tan\theta$.

10. If $x=\cos\theta+i\sin\theta$ then find $x^2+\frac{1}{x^2}$.

SECTION B — ($5\times 5=25$ marks)

Answer ALL questions.

11. (a) Find the sum of infinity of the series

$$1+\frac{2}{6}+\frac{2.5}{6.12}+\frac{2.5.8}{6.12.18}+....\infty.$$

Or

(b) Sum to infinity the series

$$1+\frac{1+2}{2!}+\frac{1+2+2^2}{3!}+....\infty.$$

12. (a) Find the equation whose roots are the roots of the equation

$4x^4+32x^3+83x^2+76x+21=0$ increased by 2 and hence solve the given equation.

Or

(b) Solve $4x^4-20x^3+33x^2-20x+4=0$.

13. (a) Show that $\begin{bmatrix}\frac{1}{\sqrt{2}} & \frac{-i}{\sqrt{2}}\\ \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}}\end{bmatrix}$ is unitary.

Or

(b) Find the characteristic root of the matrix

$$A=\begin{bmatrix}8 & -6 & 2\\ -6 & 7 & -4\\ 2 & -4 & 3\end{bmatrix}.$$

14. (a) Find the inverse of the matrix

$$A=\begin{bmatrix}2 & -1 & 1\\ -1 & 2 & -1\\ 1 & -1 & 2\end{bmatrix}.$$

Or

(b) Solve the system of equations

$3x-4y=2$

$5x+2y=12$

$-x+3y=1$.

15. (a) Expand $\cos 6\theta$ in terms of $\sin\theta$.

Or

(b) Prove that

$32Cos^6\theta=Cos6\theta+6Cos4\theta+15Cos2\theta+10$.

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